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Faunistic study of Coleoptera (Buprestidae, Carabidae, Cerambycidae, Lucanidae and Melyridae) on Gageodo Island, south-westernmost Korean Peninsula

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Abstract

Background

The Korean Archipelago consists of more than 3,348 islands, many of which have an intact biodiversity. Gageodo Island, which is the south-westernmost island in the Peninsula, is characterised by floristic and faunistic features that are distinct from those of the mainland, making it of biogeographical and ecological interest. However, due to the

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difficulties associated with surveying this Island, it remains under-investigated. In particular, the Island's coleopteran fauna remains poorly understood.

New information

In this study, the authors surveyed Buprestidae (jewel beetles), Carabidae (ground beetles), Cerambycidae (longhorn beetles), Lucanidae (stag beetles) and Melyridae (soft-winged flower beetles) on Gageodo Island. Each species was identified and ecological notes were recorded. To update the coleopteran list for the Island, previous studies that examined samples from Gageodo Island were compiled and organised. As a result, 31 species and three families were recorded on the Island for the first time, for a total of 93 species within 16 families. Of these, the melyrid species, *Intybia tsushimensis* (Satô & Ohbayashi, 1968) is reported for the first time in the Korean Peninsula. This study contributes to understand the coleopteran fauna of the biogeographically important Island in Korea and will serve as a foundational piece for understanding the fauna of Gageodo.

Keywords

biodiversity, *Intybia*, island fauna, new record, Korean Archipelago, species inventory

Introduction

The Korean Peninsula is surrounded by more than 3,348 islands, many with a well-preserved biodiversity (Honam National Institute of Biological Resources (HNIBR) 2022). Studying island organisms is important for understanding colonisation, speciation and biodiversity conservation (Gillespie and Roderick 2002). In line with this, a recent revision of the insect fauna on the islands of Korea established a preliminary checklist for 541 islands with current insect records, with a total of 6,117 species recorded (Honam National Institute of Biological Resources (HNIBR) 2022).

Gageodo Island (also known as Soheuksando; 34°04'N, 125°06'E; area: 9.1 km²) is located approximately 120 km from the mainland and is the south-westernmost island in the Korean Peninsula (Fig. 1). The terrain of the Island is rugged, characterised by the steep slopes of Mt. Doksilsan (altitude: 639 m), which is located at the heart of the Island and is the third-highest non-mainland mountain in Korea (Fig. 2A). The summit of the mountain is adorned with temperate deciduous species such as maple and oak, while the lower areas are dominated by evergreen broad-leaved forest, resulting in diverse vegetation. The Island is strongly influenced by northwesterly seasonal winds in the spring and the summer North Pacific oceanic climate. The annual average of foggy days is approximately 280, with only around 70 clear days (Korea's average is 81 clear days), indicating a high frequency of fog in the region (Korea Forest Research Institute (KFRI)

2015, National Research Institute of Maritime Cultural Heritage of Korea (NRIMCH) 2018).

Figure 1. doi

Location of Gageodo Island, South Korea. The map was taken from Google Earth (https://earth.google.com) and was edited using Adobe Photoshop 21.2.0 (Adobe Systems Inc.).

Figure 2. doi

Gageodo Island. **A** View of Mt. Doksilsan; **B** Evergreen broad-leaved forest on Mt. Doksilsan; **C** Hiking trails; **D** Grassy hill; **E** Grasslands on Mt. Doksilsan.

Figure 3. doi

Beetles observed on Gageodo Island. **A** *Galerita* (*Galerita*) *orientalis* (Carabidae); **B** *Harpalus* (*Haploharpalus*) *corporosus* (Carabidae); **C** *Pterolophia* (*Hylobrotus*) *annulata* (Cerambycidae); **D** *Nysina rufescens* (Cerambycidae); **E** *Ceresium flavipes* (Cerambycidae); **F** *Psephactus remiger remiger* (Cerambycidae); **G** *Dorcus consentaneus consentaneus* (Lucanidae); **H** *Dorcus rectus rectus* (Lucanidae); **I** *Dorcus rectus rectus* (Lucanidae).

Even though the Korean Islands have been connected to the mainland during recent glacial periods, Gageodo Island harbours unique floristic and faunistic characteristics compared to the mainland, maybe due to its being isolated in the south-westernmost location in Korea (National Research Institute of Maritime Cultural Heritage of Korea (NRIMCH) 2018). For example, the following endemic species have been reported on the island: *Pseudocneorhinus soheuksandoensis* Han & Yoon, 2000 (Curculionidae), *Bryaxis nemorosus* Choi, Park, Lee & Park, 2023 (Staphylinidae), *Coleophora fasciella* Koo & Baldizzone, 2020 (Coleophoridae), *Gammarus gageoensis* Kim, Lee & Min, 2010 (Gammaridae), *Amynthas gageodo* Blakemore, 2012 (Megascolecidae), *Eisenia gaga* Blakemore & Park, 2012 (Lumbricidae), *Potentilla gageodoensis* Kim, 2014 (Rosaceae), *Calanthe insularis* Oh, Suh & Park, 2015 (Orchidaceae) and *Calanthe rubra* Oh, Suh & Park, 2015 (Orchidaceae). Accordingly, Gageodo Island is of faunistic interest.

The first survey of the insect fauna on Gageodo Island was conducted by Shin and Noh (1970), who recorded seven orders, 34 families and 65 species, of which eight families and 24 species were from the order Coleoptera. Since this survey, only a few independent, isolated studies have been conducted (Table 1) and the list of coleopteran species on Gageodo Island remains unorganised and possibly incomplete because several coleopteran families that are common on the Korean Peninsula have not yet been documented on the Island.

Table 1.

Historical review of the reports of coleopteran species from Gageodo Island (species first described from the Island are marked with an asterisk).

Reference	Species
Shin and Noh (1970)	Chrysomelidae: *Exosoma flaviventris* (=*Charaea flaviventris*), *Exosoma* sp. (=*Charaea* sp.), *Chrysolina aurichalca* (*sic.*=*C. aurichalcea*), *Lema* sp.; Coccinellidae: *Harmionia axyridis* (*sic.*= *Harmonia axyridis*), *Epilachna igintioctomaculata* (=*Henosepilachna igintioctomaculata*), *Platynasis* sp. (=*Phymatosternus* sp.); Curculionidae: *Callirhopalus bifasciatus* (= *Pseudocneorhinus bifasciatus*), *Callirhopalus obesus* (=*Pseudocneorhinus soheuksandoensis*), *Eugnathus distinctus*, *Hylobius cribripennis* (=*Pimelocerus perforatus*), *Lixus sipressipennis* (= *Lixus depressipennis*), *Scolytus frontalis*, *Scolytus esuriens*; Elateridae: *Melanotus legatus*; Lucanidae: *Aegus laevicollis*; Scarabaeidae: *Anomala albopilosa*, *Onthophagus lenzii*, *Potosia aerata* (=*Protaetia orientalis submarmorea*); Staphylinidae: *Silpha perforata*, *Platydracus* sp.; Tenebrionidae: *Gonocephalum terminalae* (*nec.* =*Gonocephalum coenosum*), *Ulma* sp. (*sic.* = *Uloma* sp.)
Lee (1987)	Cerambycidae: *Chlorophorus muscosus*, *Pterolophia multinotata* (=*Pterolophia angusta multinotata*), *Ropica coreana*
Kim and Kim (2000)	Tenebrionidae: *Gonocephalum coenosum*
Han and Yoon (2000)	Curculionidae: *Pseudocneorhinus soheuksandoensis**
Kang (2002)	Cerambycidae: *Mesosa perplexa* (=*Agelasta perplexa*)
Kim (2011)	Scarabaeidae: *Eophileurus chinensis*, *Holotrichia diomphalia*, *Maladera fusania*, *Maladera holosericea*
Jung (2012)	Tenebrionidae: *Blindus strigosus*
Kim (2012)	Scarabaeidae: *Aphodius urostigma*, *Aphodius elegans*
Park et al. (2012)	Anthribidae: *Tropideres naevulus*
Han et al. (2013)	Brentidae: *Sergiola griseopubescens*
Cho (2014)	Staphylinidae: *Philonthus sublucanus*
Kim and Kim (2014)	Lucanidae: *Figulus punctatus*
Han et al. (2014)	Curculionidae: *Calomycterus setarius*
Jang et al. (2015)	Cerambycidae: *Nysina rufescens*, *Perissus kimi*, *Rondibilis undulata*
Hwang (2015)	Cerambycidae: *Exocentrus lineatus*, *Leptura annularis annularis*, *Psephactus remiger remiger*, *Pterolophia annulata*
Choi et al. (2018)	Staphylinidae: *Necrophila jakowlewi*, *Necrodes littoralis*
Cho (2019)	Staphylinidae: *Ocypus lewisius*, *Platydracus plebejus*
Kim et al. (2019)	Lucanidae: *Figulus binodulus*

Reference	Species
Honam National Institute of Biological Resources (HNIBR) (2022)	Cerambycidae: *Agapanthia amurensis*, *Moechotypa diphysis*; Curculionidae: *Lixus maculatus*; Elateridae: *Agrypnus binodulus coreanus*; Salpingidae: *Elacatis ocularis*; Scarabaeidae: *Cetonia pilifera pilifera*, *Gametis jucunda*, *Mimela splendens*, *Protaetia brevitarsis seulensis*
Choi et al. (2023)	Staphylinidae: *Bryaxis nemorosus**
Park et al. (2024)	Bostrichidae: *Melalgus batillus*

In this study, we surveyed Buprestidae (jewel beetles), Carabidae (ground beetles), Cerambycidae (longhorn beetles), Lucanidae (stag beetles) and Melyridae (soft-winged flower beetles) on Gageodo Island. The results from previous faunistic and taxonomic studies on Gageodo Island were then combined with our identifications to provide an updated list of coleopteran species for the Island.

Materials and methods

Three explorations were conducted on Gageodo Island in 2015 (July 27–28) and 2023 (May 26–28 and August 12–14). Specimens were collected using four methods: visual searches, sweeping, pit-fall traps and a light trap. Visual searches were conducted to collect specimens that were either resting or actively moving on flowers and leaves of plants, as well as those hiding under stones. Sweeping was conducted using an insect net (net diameter: 0.5 m; pole length: 3 m) to capture specimens by sweeping through herbaceous and woody vegetation. Pit-fall traps were set up by placing 40 plastic cups (diameter: 9.0 cm; height: 14.5 cm) at 10-metre intervals, each filled with molasses to attract beetles. A light trap was constructed using a rectangular frame (height: 1.5 m) covered with a white cloth. Inside the frame, a tripod (height: 1.0 m) was secured, supporting a 400 W mercury lamp. Specimens were collected that were attracted to the ultraviolet light.

Collected specimens were either dried and mounted or preserved in 95% ethanol (EtOH) for future study. They were then deposited in the Laboratory of Animal Systematics and Taxonomy, School of Life Sciences, College of Natural Sciences, Kyungpook National University (KNU, Daegu, Korea).

Morphological examinations were conducted using a stereoscopic microscope (Olympus SZX16, Tokyo, Japan). Photographs of the speciemens were taken using the Michrome 16 CMOS (Tucsen, Fujian, China) or the Olympus OMD EM10 Mark II digital camera.

The following catalogues are majorly referred for nomenclature: (1) Buprestidae (Löbl and Löbl 2016), (2) Carabidae (Löbl and Löbl 2017), (3) Cerambycidae (Danilevsky 2020), (4) Lucanidae (Löbl and Löbl 2016) and Melyridae (Löbl and Smetana 2007). The

identification and nomenclature of each species were based on the following recent literature: (1) Buprestidae (Lee and Ahn 2012), (2) Carabidae (Habu 1967, Habu 1973, Habu 1978, Kwon and Lee 1984, Lafer and Kataev 2008, Park and Park 2013, Park et al. 2014, Fedorenko 2021, Li et al. 2024), (3) Cerambycidae (Yamasako and Ohbayashi 2012, Jang et al. 2015, Lee and Lee 2021), (4) Lucanidae (Kim and Kim 2014, Kim et al. 2019) and (5) Melyridae (Ikeda and Yoshitomi 2017).

Checklist of coleopteran species on Gageodo Island

Order Coleoptera

Family Anthribidae

Subfamily Anthribinae

Tribe Tropiderini

Tropideres naevulus Faust, 1887

Notes: Park et al. (2012) .

Family Bostrichidae

Subfamily Polycaoninae

Melalgus batillus (Lesne, 1902)

Notes: Park et al. (2024) .

Family Brentidae

Subfamily Apioninae

Tribe Apionini

Sergiola (*Sergiola*) *griseopubescens* (Roelofs, 1874)

Notes: Han et al. (2013) .

Family Buprestidae

Subfamily Agrilinae

Tribe Agrilini

Agrilus moerens Saunders, 1873

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, 27.V.2023, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 1 male, 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: 9EFBF9BB-F771-5D0F-AE57-51EFC2BD81BE

Notes: This species was observed on a leaf of *Pueraria montana* (Fabaceae) growing on a sunny, grassy hill (Fig. 2D and Fig. 4). This is the first record of this species on Gageodo Island.

Figure 4. doi

Buprestid species from Gageodo Island: *Agrilus moerens*.

Family Carabidae

Subfamily Brachininae

Tribe Brachinini

Stenaptinus occipitalis jessoensis (Morawitz, 1862)

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 89CDA6D2-76B0-5BF0-B47D-A3478EF000D9

Notes: This species was collected during visual searches of the grasslands of low-lying coastal areas at night (Fig. 5A). This is the first record of this species on Gageodo Island.

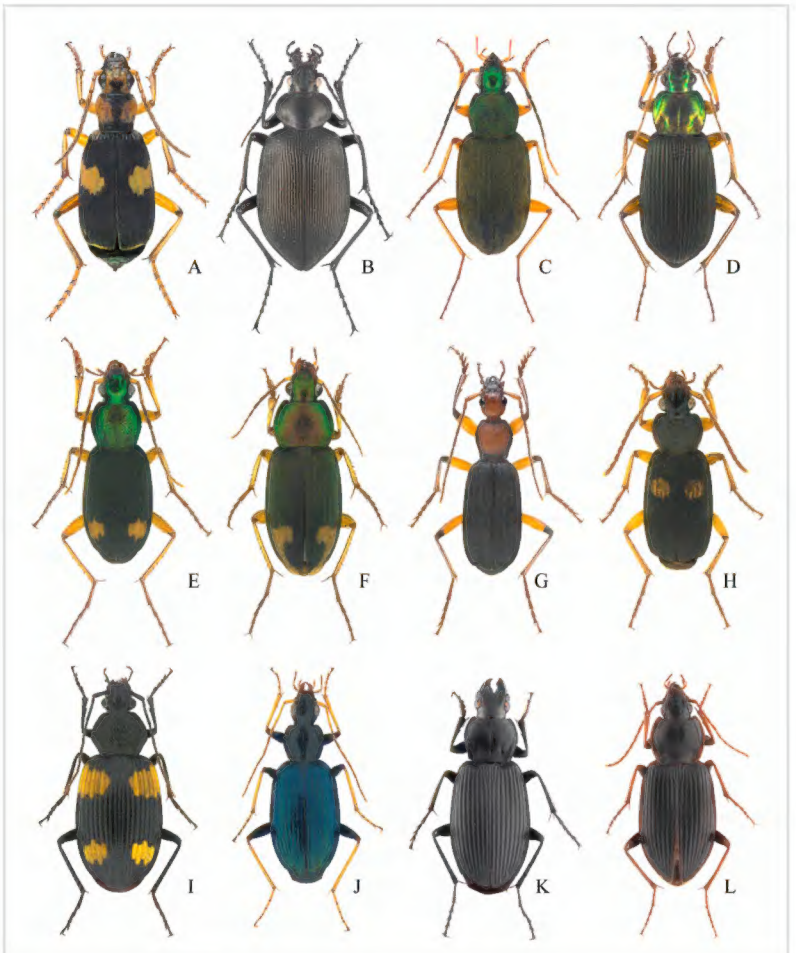

Figure 5. doi

Carabid species from Gageodo Island. **A** *Stenaptinus occipitalis jessoensis*; **B** *Calosoma* (*Calosoma*) *maximowiczi*; **C** *Chlaenius* (*Achlaenius*) *kurosawai*; **D** *Chlaenius* (*Haplochlaenius*) *costiger costiger*; **E** *Chlaenius* (*Lissauchlaenius*) *naeviger naeviger*; **F** *Chlaenius* (*Pachydinodes*) *virgulifer*; **G** *Galerita* (*Galerita*) *orientalis*; **H** *Planetes* (*Planetes*) *puncticeps*; **I** *Dischissus mirandus*; **J** *Dicranoncus femoralis*; **K** *Diplocheila* (*Submera*) *zeelandica*; **L** *Synuchus* (*Synuchus*) *cycloderus*.

Subfamily Carabinae

Tribe Carabini

Calosoma (*Calosoma*) *maximowiczi* (Morawitz, 1863)

Materials

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Donguk Kim leg.; eventDate: 28.VII.2015; sex: 2 males, 2 females; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: 7FC42F96-7760-552B-BE8C-D96251C637CC

b. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 28.V.2023; sex: 1 male; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 7FC42F96-7760-552B-BE8C-D96251C637CC

c. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 1 male, 6 females; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimens; occurrenceID: 7FC42F96-7760-552B-BE8C-D96251C637CC

Notes: This species was collected during visual searches and in pit-fall traps (Fig. 5 B). Most of the individuals (n = 10) were observed on forest roads in the mid-altitude areas of Mt. Doksilsan (Fig. 2C). This is the first record of this species on Gageodo Island.

Subfamily Harpalinae

Tribe Chalaeniini

Chlaenius (*Achlaenius*) *kurosawai* Kasahara, 1986

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 2 males; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimens; occurrenceID: 28B2E255-801C-56AF-B836-39E31257729C

Notes: This species was collected during visual searches of the grasslands of highland areas on Mt. Doksilsan (Fig. 2 and Fig. 5C). This is the first record of this species on Gageodo Island.

Chlaenius (*Haplochlaenius*) *costiger costiger* Chaudoir, 1856

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 1 male, 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimens; occurrenceID: 4EEE5155-0CB6-554E-A97D-C36B5128039D

Notes: This species was collected during visual searches and was predominantly observed on forest roads in the mid-altitude areas of the Island (Fig. 5D). This is the first record of this species on Gageodo Island.

Chlaenius (*Lissauchenius*) *naeviger naeviger* Morawitz, 1862

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 12 males, 6 females; identifiedBy: Dooyoung Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: 253A37A6-0045-5980-A85F-79DAD9E7DDBA

Notes: This species was collected during visual searches and in pit-fall traps. It was widely observed on forest roads from the lowlands to mid-mountainous areas of the Island (Fig. 2C and Fig. 5E). This is the first record of this species on Gageodo Island.

Chlaenius (*Pachydinodes*) *virgulifer* Chaudoir, 1876

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 2 males; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimens; occurrenceID: D539A386-DC75-5C1E-996C-7687ADBF7800

Notes: This species was collected during visual searches and was observed under the piles of leaves on forest roads in mid-altitude areas of the Island (Fig. 5F). This is the first record of this species on Gageodo Island.

Tribe Galeritini

Galerita (*Galerita*) *orientalis* Schmidt-Göbel, 1946

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 11 males, 10 females; identifiedBy: Dooyoung Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: 36BE5CDC-D018-5A9D-984A-13D522A2E8EE

Notes: This species was collected during visual searches and in pit-fall traps. It was widely observed on forest roads in the lowlands of Gageodo Island (Fig. 3A and Fig. 5 G). This is the first record of this species on Gageodo Island.

Planetes (*Planetes*) *puncticeps* Andrewes, 1919

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 1 male; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 03E5BF39-FD61-538F-BFC6-AB965779B846

Notes: This species was collected using pit-fall traps along hiking trails in mid-altitude areas of the Island (Fig. 2C and Fig. 5H). This is the first record of this species on Gageodo Island.

Tribe Harpalini

Anisodactylus (*Pseudanisodactylus*) *punctatipennis* Morawitz, 1862

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 2 males; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimens; occurrenceID: 314A2588-7D48-511C-9829-7991B87E2FCC

Notes: This species was collected using pit-fall traps along the hiking trails of mid-altitude areas of the Island (Fig. 2C and Fig. 6D). This is the first record of this species on Gageodo Island.

Harpalus (*Haploharpalus*) *corporosus* (Motschulsky, 1861)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 4F748C3D-DE5F-5A71-945E-8FE41389CD3E

Notes: This species was collected during visual searches and was observed in the grasslands of low-lying coastal areas at night (Fig. 3B and Fig. 6G). This is the first record of this species on Gageodo Island.

Figure 6. doi

Carabid species from Gageodo Island. **A** *Pterostichus* (*Rhagadus*) *solskyi*; **B** *Oxycentrus argutoroides*; **C** *Amara* (*Curtonotus*) *giganteus*; **D** *Anisodactylus* (*Pseudanisodactylus*) *punctatipennis*; **E** *Stenolophus* (*Astenolophus*) *fulvicornis*; **F** *Harpalus* (*Zangoharpalus*) *tinctulus*; **G** *Harpalus* (*Haploharpalus*) *corporosus*; **H** *Nipponoharpalus discrepans*.

Harpalus (*Zangoharpalus*) *tinctulus* Bates, 1873

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 96329410-04B0-59B6-863E-E7DB7024F56E

Notes: This species was collected using pit-fall traps along the hiking trails of mid-altitude areas of the Island (Fig. 2C and Fig. 6F). This is the first record of this species on Gageodo Island.

Nipponoharpalus discrepans (Morawitz, 1862)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 28.V.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 633A2B5E-E628-5F0B-A397-BEB8C14891F4

Notes: This species was collected using pit-fall traps along the hiking trails of mid-altitude areas of the Island (Fig. 2C and Fig. 6H). This is the first record of this species on Gageodo Island.

Oxycentrus (*Oxycentrus*) *argutoroides* (Bates, 1873)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: FE02EDB2-29A4-5DB6-BA5D-A1F741CEDB29

Notes: This species was collected under rocks in the grasslands of highland areas of Mt. Doksilsan (Fig. 2E and Fig. 6B). This species has both brachypterous and macropterous forms (Habu 1973) and the specimen examined here was brachypterous. This is the first record of this species on Gageodo Island.

Stenolophus (*Astenolophus*) *fulvicornis* Bates, 1873

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 1 male; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: D868CC44-35FA-59CA-955F-502C63A6BEEB

Notes: This species was collected using pit-fall traps along the hiking trails in mid-altitude areas of the Island (Fig. 2C and Fig. 6E). This is the first record of this species on Gageodo Island.

Tribe Licinini

Diplocheila (*Submera*) *zeelandica* (Redtenbacher, 1868)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 1 male; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 30D471A8-EFE3-5A0A-8AAC-6ECB61EB86D8

Notes: A dead specimen of this species was collected along the hiking trails of mid-altitude areas of the Island (Fig. 5K). This is the first record of this species on Gageodo Island.

Tribe Panagaeini

Dischissus mirandus Bates, 1873

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 28.V.2023; sex: 3 females; identifiedBy: Dooyoung Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: A3258E20-424E-5454-B485-C27E6C34CCD7

Notes: This species was collected during visual searches. It was observed on forest roads or hiking trails from the lowlands to the highland areas of Gageodo Island (Fig. 2B and Fig. 5I). This is the first record of this species on Gageodo Island.

Tribe Platynini

Dicranoncus femoralis Chaudoir, 1850

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 10 males, 5 females; identifiedBy: Dooyoung Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: AFA6A977-FF23-5C5D-B426-62F067D6BE20

Notes: This species was collected by sweeping and beating various broad-leaved trees that grow on forest roads or hiking trails, from the mid-mountainous areas to the highland areas of Mt. Doksilsan (Fig. 2B and Fig. 5J). This is the first record of this species on Gageodo Island.

Tribe Pterostichini

Pterostichus (*Rhagadus*) *solskyi* (Chaudoir, 1878)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 4 males, 9 females; identifiedBy: Dooyoung Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: F40F5F1E-A3AC-5F33-8A94-0404D7B45F80

Notes: This species was collected using pit-fall traps along the hiking trails in mid-altitude areas of the Island. It is a brachypterous species and represents the first record of this species on Gageodo Island (Fig. 6A).

Tribe Sphodrini

Synuchus (*Synuchus*) *cycloderus* (Bates, 1873)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 28.V.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 0272A8B6-1970-5653-8FF5-AAE88410FC01

Notes: This species was collected using pit-fall traps along the hiking trails in mid-altitude areas of the Island (Fig. 2C and Fig. 5L). This is the first record of this species on Gageodo Island.

Tribe Zabrini

Amara (*Curtonotus*) *giganteus* (Motschulsky, 1844)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 28.V.2023; sex: 1 female; identifiedBy: Dooyoung Kim; basisOfRecord: Dried Specimen; occurrenceID: 825F17A7-216B-53D3-A2C7-B38A424C52B0

Notes: This species was collected during visual searches and observed in the grasslands of low-lying coastal areas at night. This is the first record of this species on Gageodo Island (Fig. 6C).

Family Cerambycidae

Subfamily Cerambycinae

Tribe Callidiopini

Ceresium flavipes Fabricius, 1792

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 2 males, 2 females; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: D0F2839E-5E6E-5B68-B9F0-FBD8ED03F410

Notes: This species was collected during visual searches and some individuals were attracted to street lights in low-lying coastal areas (Fig. 3E and Fig. 7F). This is the first record of this species on Gageodo Island.

Figure 7. doi

Cerambycid species from Gageodo Island. **A** *Aegosoma sinicum sinicum*; **B** *Psephactus remiger remiger*; **C** *Xylotrechus* (*Xyloclytus*) *chinensis*; **D** *Xylotrechus* (*Xylotrechus*) *cuneipennis*; **E** *Chlorophorus muscosus*; **F** *Ceresium flavipes*; **G** *Nysina rufescens*; **H** *Pseudocalamobius japonicus*; **I** *Agelasta* (*Dissosira*) *perplexa*; **J** *Anoplophora chinensis*; **K** *Pterolophia* (*Hylobrotus*) *annulata*; **L** *Phytoecia* (*Phytoecia*) *rufiventris*.

Tribe Clytini

Chlorophorus muscosus (Bates, 1873)

Materials

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Donguk Kim leg.; eventDate: 28.VII.2015; sex: 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: FF944C06-AD34-59D8-8A33-419837A87DA3

b. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 1 male; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: FF944C06-AD34-59D8-8A33-419837A87DA3

Notes: This species was collected through visual searching on the leaves of *Mallotus japonicus* (Euphorbiaceae) growing along forest roads in the mid-altitude areas of Mt. Doksilsan (Fig. 7E). It was recorded in Gageodo Island by Lee (1987) and Hwang (2015).

Perissus kimi Niisato & Koh, 2003

Notes: Jang et al. (2015) .

Xylotrechus (*Xyloclytus*) *chinensis* (Chevrolat, 1852)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: 2D87FC65-9B21-57CB-A62E-1614C506DCE8

Notes: A dead specimen of this species was collected in mid-altitude areas of Mt. Doksilsan. This is the first record of this species on Gageodo Island (Fig. 7C).

Xylotrechus (*Xylotrechus*) *cuneipennis* (Kraatz, 1879)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Donguk Kim leg.; eventDate: 28.VII.2015; sex: 1 male, 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: AFAF9D7C-249D-5F34-ABF6-D129F22E5D51

Notes: This species was collected during visual searches. It was mating on a strut on *Machilus thunbergii* (Lauraceae), which was growing on a mountain ridge. This is the first record of this species on Gageodo Island (Fig. 7D).

Tribe Phoracanthini

Nysina rufescens (Pic, 1923)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 1 male, 2 females; identifiedBy: Donguk Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: 79442221-4AA1-5596-A6C6-6BDDF39B9F0D

Notes: This species was collected during visual searches. It was observed being active on *Machilus thunbergii* (Lauraceae) branches growing on low-lying coastal areas at night. Additionally, some individuals (n = 3) were attracted to street lights (Fig. 3D and Fig. 7G). It was recorded in Gageodo Island by Jang et al. (2015) and Lee and Lee (2021).

Subfamily Lamiinae

Tribe Acanthocinini

Rondibilis (*Rondibilis*) *undulata* (Pic, 1922)

Notes: Jang et al. (2015) .

Tribe Agapanthiini

Agapanthia (*Amurobia*) *amurensis* Kraatz, 1879

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

Pseudocalamobius japonicus (Bates, 1873)

Material

a. island: Gagedo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: 1C1FC217-A8FC-5DC5-841A-447F6EBA15BA

Notes: This species was collected by sweeping along the hiking trails in low-lying areas (Fig. 7H). This is the first record of this species on Gageodo Island.

Tribe Apomecynini

Ropica coreana Breuning, 1980

Notes: Lee (1987), Hwang (2015).

Tribe Ceroplesini

Moechotypa diphysis (Pascoe, 1871)

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

Exocentrus (*Exocentrus*) *lineatus* Bates, 1873

Notes: Hwang (2015) .

Tribe Mesosini

Agelasta (*Dissosira*) *perplexa* (Pascoe, 1858)

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 2 females; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: 210127CC-92E7-59F8-A35E-2628184EE9C7

Notes: This species was attracted to street lights in low-lying coastal areas and, in terms of its Korean distribution, it has only been recorded on Gageodo Island to date (Fig. 7I). Previously, this species was known to be active from late May to mid-July (Jang et al. 2015), but this survey confirmed that it remained active until mid-August. It was recorded in Gageodo Island by Kang (2002), Jang et al. (2015) and Hwang (2015).

Tribe Monochamini

Anoplophora chinensis (Förster, 1771)

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 1 male; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: 3CD1570A-9E8D-5C68-9C20-D663B76AF31A

Notes: This species was attracted to street lights in low-lying coastal areas (Fig. 7J). This is the first record of this species on Gageodo Island.

Tribe Phytoeciini

Phytoecia (*Phytoecia*) *rufiventris* Gautier des Gottes, 1870

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 2 males, 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: 6E4CC22D-6B73-591E-AE70-C12BF9CDBAF4

Notes: This species was collected during a visual search of *Artemisia princeps* (Asteraceae), growing on a coastal cliff (Fig. 7L). This is the first record of this species on Gageodo Island.

Tribe Pteropliini

Pterolophia (*Hylobrotus*) *annulata* (Chevrolat, 1845)

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 27.V.2023; sex: 2 females; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: C1212CB2-7774-5570-AA04-04B33A24093E

Notes: This species was attracted to street lights in low-lying coastal areas (Fig. 3C and Fig. 7K). It was first recorded in Gageodo Island by Hwang (2015).

Pterolophia (*Pterolophia*) *angusta multinotata* (Pic, 1931)

Notes: Lee (1987) .

Subfamily Lepturinae

Tribe Lepturini

Leptura (*Leptura*) *annularis* Fabricius, 1801

Notes: Hwang (2015) .

Subfamily Prioninae

Tribe Aegosomatini

Aegosoma sinicum sinicum White, 1853

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Donguk Kim leg.; eventDate: 28.VII.2015; sex: 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: 50D12E91-D524-54FF-B42C-D50C7ABB3F79

Notes: This species was attracted to light traps in the forests of low-lying coastal areas (Fig. 7A). This is the first record of this species on Gageodo Island.

Tribe Anacolini

Psephactus remiger remiger Harold, 1879

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 14.VIII.2023; sex: 2 females; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: CA6E8ED0-135C-5137-AE9C-1C3788731958

Notes: This species was collected during visual searches of wooden fences along the hiking trails in mid-mountainous areas (Fig. 2C, Fig. 3F and Fig. 7B). It was first recorded in Gageodo Island by Hwang (2015).

Family Chrysomelidae

Subfamily Chrysomelinae

Tribe Doryphorini

Chrysolina (*Anopachys*) *aurichalcea* (Mannerheim, 1825)

Notes: Shin and Noh (1970) .

Subfamily Criocerinae

Tribe Lemini

Lema sp.

Notes: Shin and Noh (1970) .

Subfamily Galerucinae

Tribe Luperini

Charaea flaviventris (Motschulsky, 1860)

Notes: Shin and Noh (1970) .

Charaea sp.

Notes: Shin and Noh (1970) .

Family Coccinellidae

Subfamily Coccinellinae

Tribe Coccinellini

Harmonia axyridis (Pallas, 1773)

Notes: Shin and Noh (1970) .

Tribe Epilachnini

Henosepilachna vigintioctomaculata (Motschulsky, 1857)

Notes: Shin and Noh (1970) .

Tribe Platynaspidini

Phymatosternus sp.

Notes: Shin and Noh (1970) .

Family Curculionidae

Subfamily Entiminae

Tribe Cyphicerini

Calomycterus setarius Roelofs, 1873

Notes: Han et al. (2014) .

Tribe Sitonini

Eugnathus distinctus Roelofs, 1873

Notes: Shin and Noh (1970) .

Tribe Trachyphloeini

Pseudocneorhinus bifasciatus Roelofs, 1879

Notes: Shin and Noh (1970) .

Pseudocneorhinus soheuksandoensis Han & Yoon, 2000

Notes: Han and Yoon (2000), Honam National Institute of Biological Resources (HNIBR) (2022).

Subfamily Lixinae

Tribe Lixini

Lixus (*Dilixellus*) *depressipennis* Roelofs, 1873

Notes: Shin and Noh (1970) .

Lixus (*Dilixellus*) *maculatus* Roelofs, 1873

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

Subfamily Molytinae

Tribe Hylobiini

Pimelocerus perforatus (Roelofs, 1873)

Notes: Shin and Noh (1970) .

Subfamily Scolytinae

Tribe Scolytini

Scolytus frontalis Blandford, 1894

Notes: Shin and Noh (1970) .

Scolytus esuriens Blandford, 1894

Notes: Shin and Noh (1970) .

Family Elateridae

Subfamily Agrypninae

Tribe Agrypnini

Agrypnus binodulus coreanus Kishii, 1961

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

Subfamily Elaterinae

Tribe Melanotini

Melanotus (*Melanotus*) *legatus legatus* Candèze, 1860

Notes: Shin and Noh (1970), Honam National Institute of Biological Resources (HNIBR) (2022).

Family Lucanidae

Subfamily Lucaninae

Tribe Aegini

Aegus laevicollis subnitidus Waterhouse, 1873

Notes: Shin and Noh (1970), Kim and Kim (2010), Kim and Kim (2014), Honam National Institute of Biological Resources (HNIBR) (2022).

Tribe Dorcini

Dorcus consentaneus consentaneus (Albers, 1886)

Materials

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Donguk Kim leg.; eventDate: 28.VII.2015; sex: 1 male; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimen; occurrenceID: ACCCBB97-7CEB-5B50-AB06-AE5D0BA55B68

b. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023;

sex: 11 males, 9 females; identifiedBy: Donguk Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: ACCCBB97-7CEB-5B50-AB06-AE5D0BA55B68

Notes: Most of the individuals (n = 16) were collected in pit-fall traps in the mid-mountainous areas of Mt. Doksilsan. Some individuals (n = 4) were observed feeding on the sap of *Machilus thunbergiai* (Lauraceae) growing on mountain ridges or walking on forest roads (Fig. 3G and Fig. 8A). This is the first record of this species on Gageodo Island.

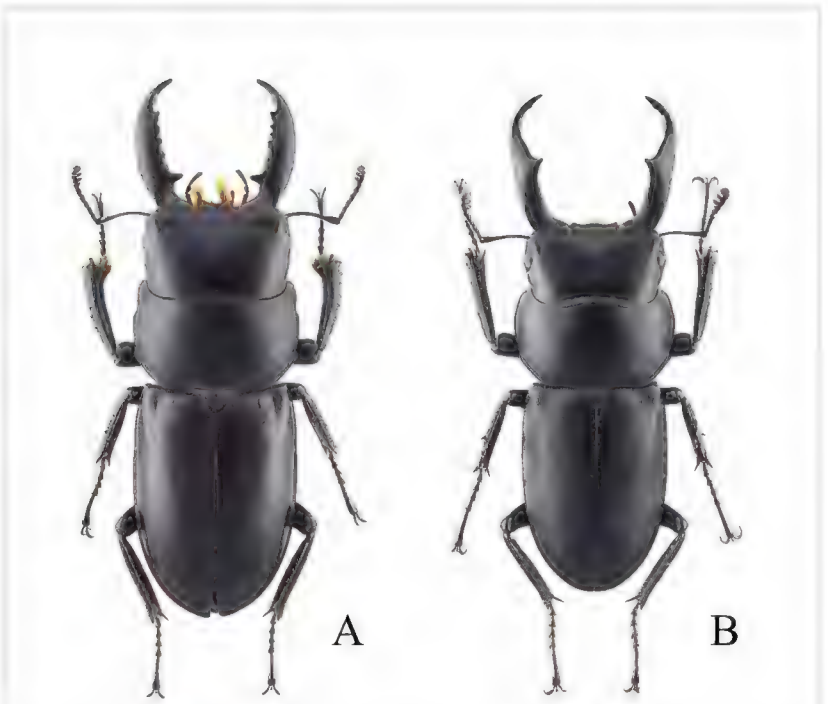

Figure 8. doi

Lucanid species from Gageodo Island. **A** *Dorcus consentaneus consentaneus*; **B** *Dorcus rectus rectus*.

Dorcus rectus rectus (Motschulsky, [1858])

Materials

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Donguk Kim leg.; eventDate: 28.VII.2015; sex: 1 male, 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: 93375A2C-CD19-534E-9F32-FE324667D607

b. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 26.V.2023; sex: 8 males, 10 females; identifiedBy: Donguk Kim; basisOfRecord: Dried & Ethanol-Preserved Specimens; occurrenceID: 276ED401-6C1B-5AD3-8DDA-FD8301D65DAE

Notes: This species was collected during visual searches and in pit-fall traps. It was widely observed on forest roads from the lowland to the highland areas of Gageodo Island and some individuals (n = 8) were also attracted to street lights in low-lying coastal areas (Fig. 3H, I and Fig. 8B). This is the first record of this species on Gageodo Island.

Tribe Figulini

Figulus binodulus Waterhouse, 1873

Notes: Kim et al. (2019) .

Figulus punctatus punctatus Waterhouse, 1873

Notes: Kim and Kim (2014), Kim et al. (2019).

Family Melyridae

Subfamily Malachiinae

Tribe Malachiini

Intybia tsushimensis (Satô & Ohbayashi, 1968)

Material

a. island: Gageodo Island; country: South Korea; stateProvince: Jeollanam-do; locality: Shinan-gun, Heuksan-myeon, Gageodo-ri, Sang Jae Suh Coll.; eventDate: 13.VIII.2023; sex: 2 males, 1 female; identifiedBy: Donguk Kim; basisOfRecord: Dried Specimens; occurrenceID: 1C14E266-6849-5024-B9F1-5DFEE7B5C847

Diagnosis: Elytra with a reddish-orange or yellowish fascia, slightly or gradually narrowed to suture and sometimes divided into two fasciae by suture; legs entirely black; antennae yellow, with black or dark brown antennomeres V–XI; endophallus without spinous plate; spinous area composed with short triangular spines (Fig. 9F).

Notes: This species was first recorded in Korea by Kang (2014) and subsequently listed in the national Korean insect checklist (National Institute of Biological Resources (NIBR) 2019, Korean Society of Applied Entomology (KSAE) and The Entomological Society of Korea (ESK) 2021). However, it was determined to be a misidentification of *Intybia kishii* (Nakane, 1955), based on a reference image and diagnosis. Therefore, *I. tsushimensis* (Satô & Ohbayashi, 1968) is a new record for Korea, as revealed by this study. Our recent extensive survey has uncovered that *I. tsushimensis*, previously known as an endemic species of Japan (specifically Tsushima Island), is distributed throughout the Korean Peninsula (Kim and Suh, unpublished data). It was collected by sweeping along the evergreen broad-leaved forest roads in the mid-mountainous areas of Mt. Doksilsan (Fig. 2C).

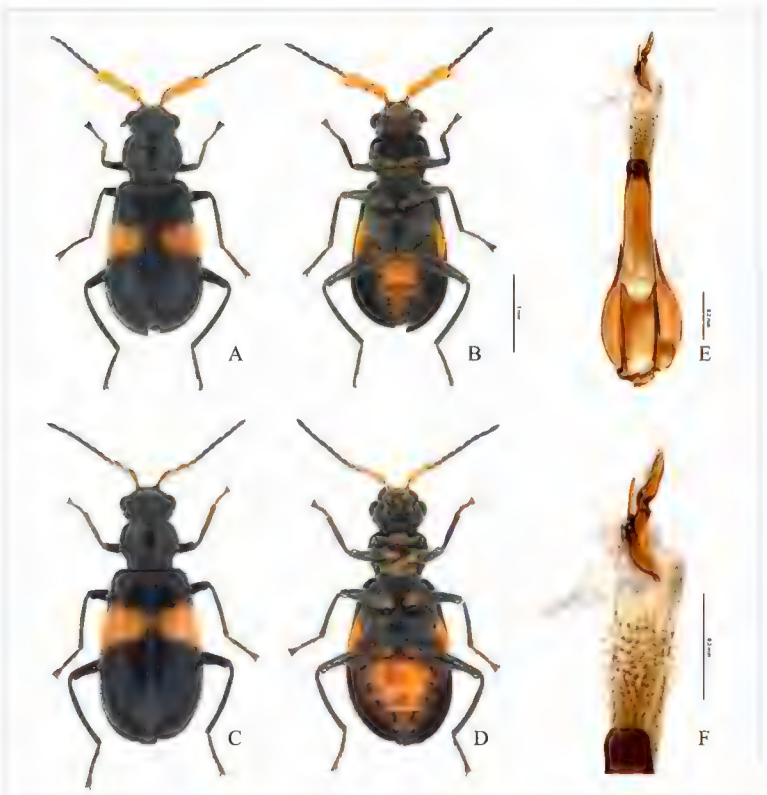

Figure 9. doi

Melyrid species from Gageodo Island, *Intybia tsushimensis*. **A** male, dorsal view; **B** male, ventral view; **C** female, dorsal view; **D** female, ventral view; **E** male genitalia; **F** endophallus.

Family Salpingidae

Subfamily Othniinae

Elacatis ocularis (Lewis, 1891)

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

Family Scarabaeidae

Subfamily Aphodiinae

Tribe Aphodiini

Aphodius (*Aganocrossus*) *urostigma* Harold, 1862

Notes: Kim (2012) .

Aphodius (*Aphodius*) *elegans* Allibert, 1847

Notes: Kim (2012) .

Subfamily Cetoniinae

Tribe Cetoniini

***Cetonia* (*Eucetonia*) *pilifera pilifera* (Motschulsky, 1860)**

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

***Gametis jucunda* (Faldermann, 1935)**

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

***Protaetia brevitarsis seulensis* (Kolbe, 1886)**

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

***Protaetia orientalis submarmorea* (Burmeister, 1842)**

Notes: Shin and Noh (1970), Kim (2011).

Subfamily Dynastinae

Tribe Phileurini

***Eophileurus chinensis* (Faldermann, 1835)**

Notes: Kim (2011) .

Subfamily Melolonthinae

Tribe Melolonthini

***Holotrichia diomphalia* (Bates, 1888)**

Notes: Kim (2011) .

Tribe Sericini

***Maladera fusania* (Murayama, 1934)**

Notes: Kim (2011) .

Maladera holosericea (Scopoli, 1772)

Notes: Kim (2011) .

Subfamily Ruetelinae

Tribe Anomalini

Anomala albopilosa Hope, 1839

Notes: Shin and Noh (1970), Kim (2011).

Mimela splendens (Gyllenhal, 1817)

Notes: Honam National Institute of Biological Resources (HNIBR) (2022) .

Subfamily Scarabaeinae

Tribe Onthophagini

Onthophagus (*Strandius*) *lenzii* Harold, 1874

Notes: Shin and Noh (1970) .

Family Staphylinidae

Subfamily Pselaphinae

Tribe Bythinini

Bryaxis nemorosus Choi, Park, Lee & Park, 2023

Notes: Choi et al. (2023) .

Subfamily Silphinae

Necrophila (*Eusilpha*) *jakowlewi jakowlewi* (Semenov, 1891)

Notes: Cho (2013), Choi et al. (2018).

Necrodes littoralis (Linneaus, 1758)

Notes: Cho (2013), Choi et al. (2018).

Silpha (*Silpha*) *perforata* Gebler, 1832

Notes: Shin and Noh (1970), Honam National Institute of Biological Resources (HNIBR) (2022).

Subfamily Staphylininae

Tribe Staphylinini

Ocypus (*Pseudocypus*) *lewisius* Sharp, 1874

Notes: Cho (2019) .

Philonthus (*Philonthus*) *sublucanus* Herman, 2001

Notes: Cho (2014) .

Platydracus (*Platydracus*) *plebejus* (Bernhauer, 1915)

Notes: Cho (2019) .

Platydracus sp.

Notes: Shin and Noh (1970) .

Family Tenebrionidae

Subfamily Tenebrioninae

Tribe Opatrini

Gonocephalum (*Gonocephalum*) *coenosum* Kaszab, 1952

Notes: Shin and Noh (1970), Kim and Kim (2000), Jung (2012), Honam National Institute of Biological Resources (HNIBR) (2022).

Tribe Pedinini

Blindus strigosus (Faldermann, 1835)

Notes: Jung (2012) .

Tribe Ulomini

Uloma sp.

Notes: Shin and Noh (1970) .

Analysis

Composition of Coleoptera on Gageodo Island

In this study, the presence of Buprestidae, Carabidae and Melyridae on Gageodo Island was confirmed for the first time and 31 species from the five investigated coleopteran families were newly added to the fauna of Gageodo Island. Furthermore, after combining the results from previous studies that have used samples from Gageodo Island, a list of 93 species within 16 families was constructed. Of these families, Carabidae and Cerambycidae demonstrated the highest species diversity, with 20 species each (22%), followed by Scarabaeidae with 13 species (14%), Curculionidae with nine species (10%) and Staphylinidae with eight species (9%) (Fig. 10).

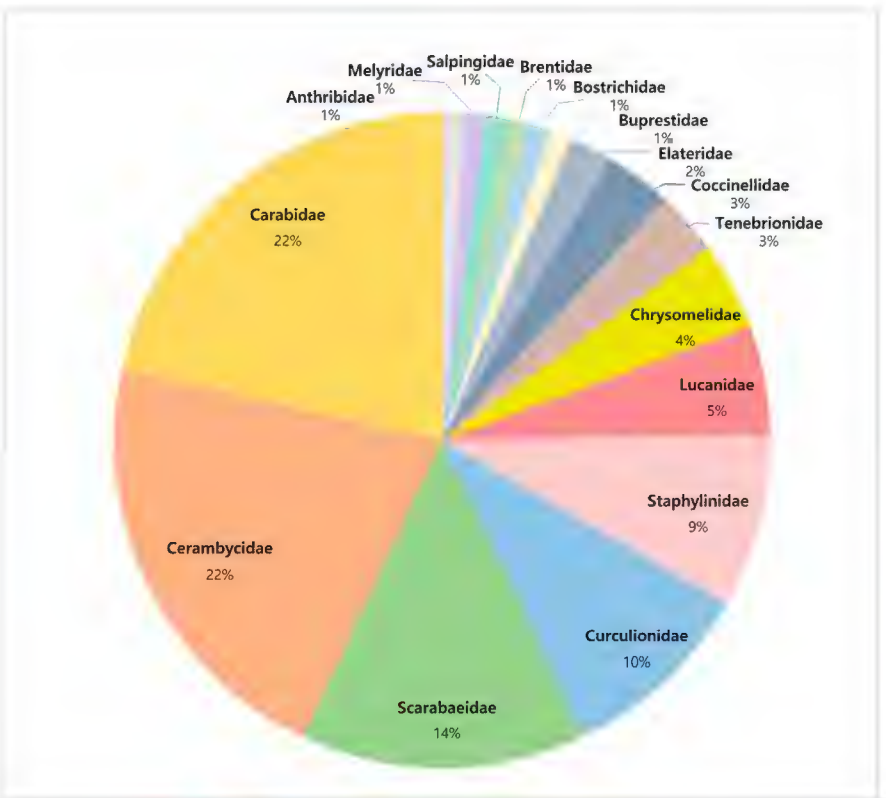

Figure 10. doi

Composition of the coleopteran families on Gageodo Island.

Discussion

Notes on the coleopterans on Gageodo Island

Buprestid and cerambycid beetles are involved in highly specialised interactions with host plants and the species composition and diversity of these taxa are affected by plant diversity (Evans et al. 2007, Fahri et al. 2016, Pérez-Hernández et al. 2022). Gageodo Island has unique floristic characteristics (Yang et al. 2013, So et al. 2014, Oh et al. 2015); thus the diversity of phytophagous beetles may also be high on the Island. However, only one species of buprestid beetle was found during our surveys and it is the only species recorded to date on the Island. The weather conditions during the surveys, including overcast skies and rain, may have affected the results since adult buprestids are diurnal and photophilic (Evans et al. 2007). The Island has various host plants for buprestid beetles, including *Catanopisis sieboldii* (Fagaceae), *Quercus acuta* (Fagaceae), *Machilus thunbergia* (Lauraceae) and *Rubus buergeri* (Rosaceae), indicating the potential for the discovery of more species from genera such as *Agrilus*, *Trachys*, *Habroloma* etc. (Yang et al. 2013, Ohmomo and Fukutomi 2013).

Cerambycid beetles have been well-studied on the Korean Peninsula (e.g. Lee (1987), Jang et al. (2015), Hwang (2015) and Lee and Lee (2021)), with over 350 species within six subfamilies (Prioninae, Lepturinae, Spondylidinae, Necydalinae, Cerambycinae, Lamiinae) recognised to date. Amongst the species found on Gageodo Island, *Agelasta perplexa* and *Nysina rufescens* are only known from the insular region of the Korean Peninsula. In particular, in Korea, *A. perplexa* exhibits a unique distribution limited to Gageodo Island and the northernmost distribution limit zone for both species extends to South Korea and Japan in East Asia (Fig. 11).

Carabid beetles represent a species-rich taxon, with over 700 species and subspecies documented on the Korean Peninsula (Korean Society of Applied Entomology (KSAE) and The Entomological Society of Korea (ESK) 2021). Though faunistic surveys of this family have been frequently conducted, they have been restricted to mountainous regions (Jung et al. 2012, Jung et al. 2013, Lee et al. 2014, Jung et al. 2015, Hong et al. 2017) and Jejudo Island (Paik 1988, Paik and Kwon 1993, Paik 1997, Paik and Jung 2003, Paik and Jung 2004, Honam National Institute of Biological Resources (HNIBR) 2022); thus surveys on other islands need to be conducted. The present study found 20 carabid species new to the fauna of Gageodo Island. Of these, *Chlaenius kurosawai* is new to the insular region of the Korean Peninsula (Honam National Institute of Biological Resources (HNIBR) 2022). This record makes Gageodo Island the westernmost record for its distribution range. As carabid beetles occupy diverse habitats and microhabitats (Arndt 2005, Kotze et al. 2011), further surveys with a more diverse range of collection methods (e.g. light and malaise traps) may lead to a better understanding of the carabid fauna of the Island.

Lucanid beetles are another well-studied group in Korea, with a total of 16 species recorded on the Korean Peninsula (Kim and Kim 2014, Kim et al. 2019). Of these, *Dorcus rectus rectus* and *Dorcus titanus castanicolor* are the most common species and are

distributed across the Peninsula, including insular regions (Kim and Kim 2014, Kim et al. 2019, Honam National Institute of Biological Resources (HNIBR) 2022). In particular, *D. titanus castanicolor* is found on islands such as Baekryeongdo, Jejudo and Ulleungdo Island, which are distant from the mainland (Kim and Kim 2014). It is also known to inhabit islands near Gageodo Island, such as Hongdo (Kim and Kim 2014) and Jindo (Kim and Suh, unpublished data). However, mysteriously, it has not yet been confirmed to be present on Gageodo Island (Kim and Kim 2014, Kim et al. 2019, Honam National Institute of Biological Resources (HNIBR) 2022). *Dorcus consentaneus*, which has a similar life history to *D. titanus castanicolor* (Kim and Kim 2014) was typically dominant on the Island along with *D. rectus*.

Figure 11. doi

Distribution map of *Agelasta perplexa* (green dots) and *Nysina rufescens* (orange dots). The map was taken from Snazzy Maps (https://snazzymaps.com) and edited using Adobe Photoshop 21.2.0 (Adobe Systems Inc.). (Sources: Hayashi et al. (1984), Jang et al. (2015), Lee and Lee (2021); GBIF [http://www.gbif.org]; INaturalist [https://www.inaturalist.org]).

Melyrid beetles are generally a common, but poorly studied group in Korea, with only a few studies having been conducted (Kang 2014, Ikeda and Yoshitomi 2017, Lee et al. 2020). In the present study, *Intybia tsushimensis*, previously known as an endemic species of Japan (specifically Tsushima Island), was confirmed to be present in Korea for the first time, following a mistaken record, representing the south-westernmost occurrence of the species.

Other species-rich coleopteran families such as Curculionidae (weevils), Chrysomelidae (leaf beetles) and Staphylinidae (rove beetles) remain underinvestigated and thus require further surveys.

Species of interest

Climate change has a significant impact on the geographical distribution of biological organisms globally and selecting indicator species can be used to make informed and effective ecosystem management decisions (Kelly and Goulden 2008, Lee et al. 2010, Siddig et al. 2016, Liang et al. 2018). Accordingly, 100 climate-sensitive biological indicator species (CBIS), encompassing vertebrates, invertebrates and plants, were designated to monitor the influence of climate change on the distribution of biological species on the Korean Peninsula (Lee et al. 2010). Of the beetle species identified on Gageodo Island, two cerambycid species, *Agelasta perplexa* and *Nysina rufescens*, could be considered CBIS candidates, based on the criteria proposed by Lee et al. (2010). The northernmost distribution limit zone for these species is South Korea and Japan in East Asia (Fig. 11); thus their distribution limits in this area hold important biogeographical value. Moreover, their host plants are associated with the warm temperate evergreen broad-leaved tree species *Machilus thunbergii* (Lauraceae), which has been reported to be extending its northern distribution limit range (Shin et al. 2022). Considering their distribution and host plants, there is a possibility that their habitat boundaries may expand due to climate change on the Korean Peninsula. Continuous monitoring efforts are required to assess their possibility as a climate indicator and to track habitat boundary shifts in response to climate change.

Conclusion

The Korean Peninsula has great potential as a study area for furthering the understanding of island biogeography due to its numerous islands of various sizes and varying distances from the mainland. Gageodo Island is the south-westernmost island, thus its floristic and faunistic data are particularly valuable for understanding Korean island biogeography. This study discovered previously unrecorded coleopteran species on the island in Korea and established the first organised Coleoptera checklist, providing foundational insights into the coleopteran fauna of this biogeographically important island and serving as a basic resource for future research.

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